Remarks

Claims 1-20 are now pending in the present application. It is respectfully submitted that the pending claims define allowable subject matter.

Claims 1-3 and 5-20 are rejected under 35 USC § 103(a) as being unpatentable over Sheehan et al. (USP 6,106,466) ("Sheehan") in view of Wiesauer et al. (USP 6,482,159) ("Wiesauer"). Claim 4 is rejected under 35 USC § 103(a) as being unpatentable over Sheehan in view of Wiesauer and further in view of Yamauchi (USP 7,110,583) ("Yamauchi"). Applicants respectfully traverse these rejections for reasons set forth hereafter.

Claim 1 recites an apparatus for detecting a contour of an object within an image, comprising, among other things, "a user interface for selecting first and second points within an object" and "a processor for detecting first and second subcontours based on said first and second points, respectively, said first and second subcontours being based on detected edges." With regard to claim 1, Sheehan does not suggest or disclose the recitation of "a processor for detecting first and second subcontours based on said first and second points, respectively, said first and second subcontours being based on detected edges." Instead, Sheehan discloses a fundamentally different method for detecting a contour.

Sheehan relies on the use of a mesh model "based upon an archetype shape derived from shapes of the plurality of the training data hearts." (Col. 6, lines 15-17). Referring to FIG. 1 of Sheehan, "FIG. 1 includes a top level or overview flow chart 20 that broadly defines the steps of a preferred method used in the present invention for automatically detecting the borders of the left ventricle of the heart and for producing a three-dimensional shape contour of that (or another portion of the heart)." (Col. 11, lines 29-34). In block 24 of FIG. 1, "three points representing specific anatomic landmark structures are manually traced in the images that were created in block 22." (Col. 11, lines 39-41). Then, in block 26 of FIG. 1, "the mesh representing the archetype shape is rigidly aligned to each of the images produced by imaging the heart of patient 48 using the three traced points or anatomical landmarks in each image." (Col. 14, lines 53-56, emphasis added). Therefore, the system of Sheehan relies specifically on the use of the predetermined mesh, and there is no description or suggestion to detect an edge

proximate to any defined point without the use of the predetermined mesh. Specifically, in block 32 of FIG. 1, "[a]utomated border detection is performed by optimizing a fit of images predicted from the mesh model, to the patient's images." (Col. 15, lines 13-16).

In contrast, in Applicants' claimed invention recited in claim 1, the first and second subcontours are each based on a user selected point within an object that is in an image, and each of the first and second subcontours are based on detected edges within the object. This is different than the system of Sheehan, which uses points to fit a predetermined mesh model to an image. Sheehan then detects a border by optimizing a fit of images predicted from the mesh model. Thus, any border detected in the image is based on the mesh model, not on detected edges.

Furthermore, it is submitted that Wiesauer does not make up for the deficiencies of Sheehan with respect to claim 1. Wiesauer is not concerned with detecting first and second subcontours based on said first and second points, respectively, and is not concerned with the recitation of claim 1 of "said processor combining said first and second subcontours into a contour." Wiesauer's main intention is to characterize the surface of an object. (Col. 2, lines 18-20). Wiesauer states that "for the representation of one or more objects with one or more interesting layers the geometrical selection criterion is a shell which approximates a surface of the object or of a layer and which can have a certain thickness, and only signals which are selected by the shell will be processed and displayed." (Abstract, lines 6-11). As stated in the Office Action, Wiesauer discloses that "a histogram is calculated from the selected information." (Col. 2, lines 35-36). It is respectively submitted that a histogram is not a subcontour or a contour. Further, Wiesauer states that "[a]nother option of the present invention is also to display simultaneously a variety of images as e.g. a 3D image combine with a histogram of the flow distribution on the surface of the object whereby the surface is superimposed to the 3D image so that the complex spatial relationship can be visualized." (Col. 2, lines 42-47). Therefore, the combination of the histogram and 3D image as taught by Wiesauer is as an overlay, and is unrelated to combining first and second subcontours into a contour as recited in claim 1.

It is also submitted that Sheehan in combination with Wiesauer does not teach or suggest the Applicants' claims 9 and 17. Independent claim 9 recites "identifying a first subcontour based on said first point", "identifying a second subcontour based on said second point" and "defining a contour based on said first and second subcontours." Independent claim 17 recites "searching for edges within said image around said points as said points are selected, said edges being representative of non-uniformities in said pixel or Voxel data, said edges defining subcontours around each of said points" and "combining said subcontours into a contour as each of said subcontours is defined." For similar reasons set forth above, Sheehan and Wiesauer, alone or in combination, do not describe or suggest each of the recitations of claims 9 and 17. Accordingly, claims 9 and 17 are also submitted to be patentable over Sheehan in view of Wiesauer.

With respect to the dependent claims, Sheehan in view of Wiesauer fails to teach each of the recitations of the dependent claims. Turning specifically to claim 3, claim 3 recites "said processor further comprising a pre-set limit, said pre-set limit defining image subsets with respect to said first and second points, said processor searching said image subsets for said detected edges." The "pre-set limit" and "image subset" are discussed in paragraph 29 and FIG. 3 of Applicants' specification, specifically "[t]he outer ranges 158 define image subsets 162 and 164 around first and second points 154 and 156, respectively, which are portions of the image 150 that the contour detection processor 46 will look within for an edge. The outer range 158 may be a predefined distance, or a pre-set limit, from the associated first and second points 154 and 156." In contrast, Sheehan does not define any image subset with respect to a selected point within which the processor will search.

Turning to claim 7, claim 7 recites "an input for deselecting a point within said contour, said processor defining an updated contour excluding said point." Sheehan allows manually editing, stating that "if the operator wants to manually edit the abstract mesh of the mesh model, the editing process is implemented manually." (Col. 17, lines 35-37). Therefore, Sheehan does not teach or suggest the processor defining an updated contour excluding said point; instead, the manual editing is conducted separately from the mesh fitting.

With regard to claim 11, claim 11 recites "joining said first and second subcontours with first and second lines or tangents, said first and second lines or tangents being drawn based on top and bottom locations of said first and second subcontours, said contour being defined based on said first and second lines or tangents." Sheehan is silent to identifying the subcontours based on the points, as discussed previously with respect to claims 1 and 9. Also, Sheehan uses a mesh model specific to the heart, and thus does not teach or suggest defining the contour based on lines or tangets that are drawn based on the first and second subcontours.

Turning to the 103 rejection of claim 4, Applicants respectfully submit that Yamauchi fails to make up for the deficiencies of Sheehan in view of Wiesauer. Claim 4 recites "an ultrasonic transducer for transmitting and receiving ultrasonic information, said processor creating said contour in real-time." In contrast, Wiesauer discloses "an automatic contour extracting unit for extracting a contour of the object from the ultrasound image by performing a predetermined operation on the ultrasound image. With this construction, the contour of the object is extracted from the ultrasound image by using the ultrasound image itself. As a result, the operator does not need to perform troublesome input operations." (Col. 2, lines 58-66). Therefore, Yamauchi teaches away from detecting a contour as disclosed by the Applicants that has "a user interface for selecting first and second points within an object" and "detecting first and second subcontours based on said first and second points."

In view of the foregoing comments, it is respectfully submitted that the prior art fails to teach or suggest the claimed invention. Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone number listed below.

Respectfully Submitted,

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